



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022**

COURSE NAME : PRE CAST STRUCTURAL DESIGN
COURSE CODE : BFS 41103
PROGRAMME CODE : BFF
EXAMINATION DATE : JANUARY / FEBRUARY 2022
DURATION : 3 HOURS
INSTRUCTION : 1. ANSWER **ALL** QUESTIONS.
2. All CALCULATION MUST BE BASED ON EN 1992-1-1.
3. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **OPEN BOOK**.



THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

- Q1** Figure Q1(a) shows the typical floor plan of a double storey braced building using precast concrete system. The floor is made by 150 mm thick precast concrete solid slabs supported by the precast concrete beams. The beams are connected to the precast column. The elevation of the precast column C1 is shown in Figure Q1(b). The precast concrete beams (PCB 1) are sitting on the corbels as shown in Figure Q1(c). Given the following data:

Precast concrete beam (PCB 1)	=	250 mm x 600 mm
Column C1	=	250 mm x 250 mm
Width of corbel	=	250 mm
Dimension of bearing pad	=	250 mm x 150 mm x 20 mm
Unit weight of concrete	=	25 kN/m ³
Brickwall	=	5.0 kN/m ²
Concrete topping and finishes	=	1.5 kN/m ²
Variable action	=	5 kN/m ²
Nominal concrete cover	=	30 mm
Strength of concrete, f_{ck}	=	35 N/mm ²
Strength of steel reinforcement, f_{yk}	=	500 N/mm ²

- (a) Evaluate the actions on PCB 1 and calculate the maximum axial force acting on the first floor corbel at column C1. Ignore the size of corbel. (10 marks)
- (b) Check the bearing stress of the bearing pad. (4 marks)
- (c) Design the reinforcement for the corbel. Assume the bearing is flexible and at a distance (a_H) = 65 mm above the tension tie. (15 marks)
- (d) Draw the detailing for the corbel. (5 marks)
- (e) If the same bearing pad is used for the corbel at the internal column, will it be adequate? Justify your answer. (6 marks)
- Q2** Figure Q2 shows part of the upper floor plan of a commercial building. The floor of the building uses precast concrete unpropped system consist of 175 mm thick precast concrete planks and 65 mm concrete topping. Given the following data:

Unit weight of concrete	=	25 kN/m ³
Strength of concrete, f_{ck}	=	30 N/mm ²
Strength of steel reinforcement, f_{yk}	=	500 N/mm ²
Finishes & Services	=	1.0 kN/m ²
Imposed load	=	3.0 kN/m ²

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Temporary load during installation	=	1.0 kN/m ²
Nominal concrete cover	=	25 mm
Bar diameter	=	12 mm

- (a) Determine the design moments of the precast concrete planks during installation stage and service stage. (6 marks)
- (b) Design all the reinforcements for the precast concrete planks. (8 marks)
- (c) Check the vertical shear. (6 marks)
- (d) Check the cracking. (5 marks)
- (e) If the deflection check is failed, propose a solution without changing the thickness of the concrete planks. State the required changes in the design. (5 marks)
- Q3** **Figure Q3** shows a temporary structural system used to carry a maximum concentrated load of 500 kN at A. The system is fixed to the wall at B and pinned at C. The high strength steel rod is tied to the precast beam at A. The precast concrete beam is used for a precast floor system with reinforcement as shown in Section x-x designed to carry bending only.
- (a) Calculate the internal force resisted by the precast beam and high strength steel rod. (6 marks)
- (b) Check the adequacy of the precast beam to resist the internal force. Given $f_{ck} = 25$ MPa, $f_{yk} = 500$ MPa, nominal concrete cover = 30 mm, $k_r = 1.0$, $k_\phi = 1.3$ and ignore self-weight of precast beam. (20 marks)
- (c) If another concentrated load of 200 kN is to be carried at B also, what would be the effect of the precast beam? Explain the reason. (4 marks)

- END OF QUESTIONS-



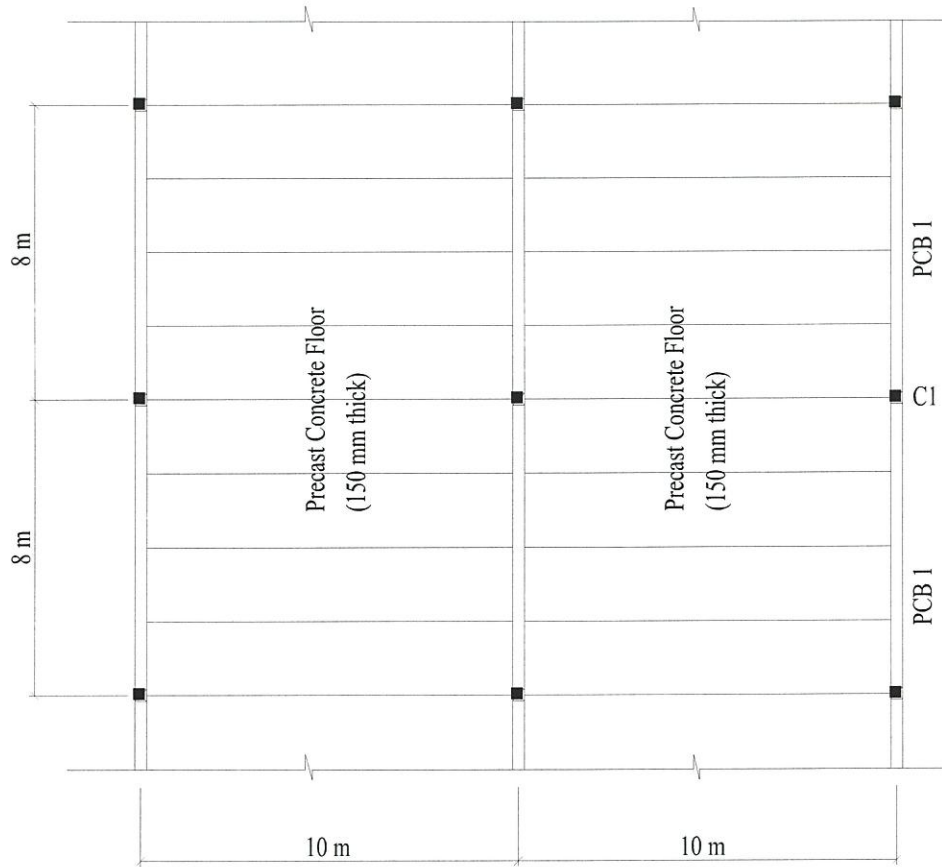
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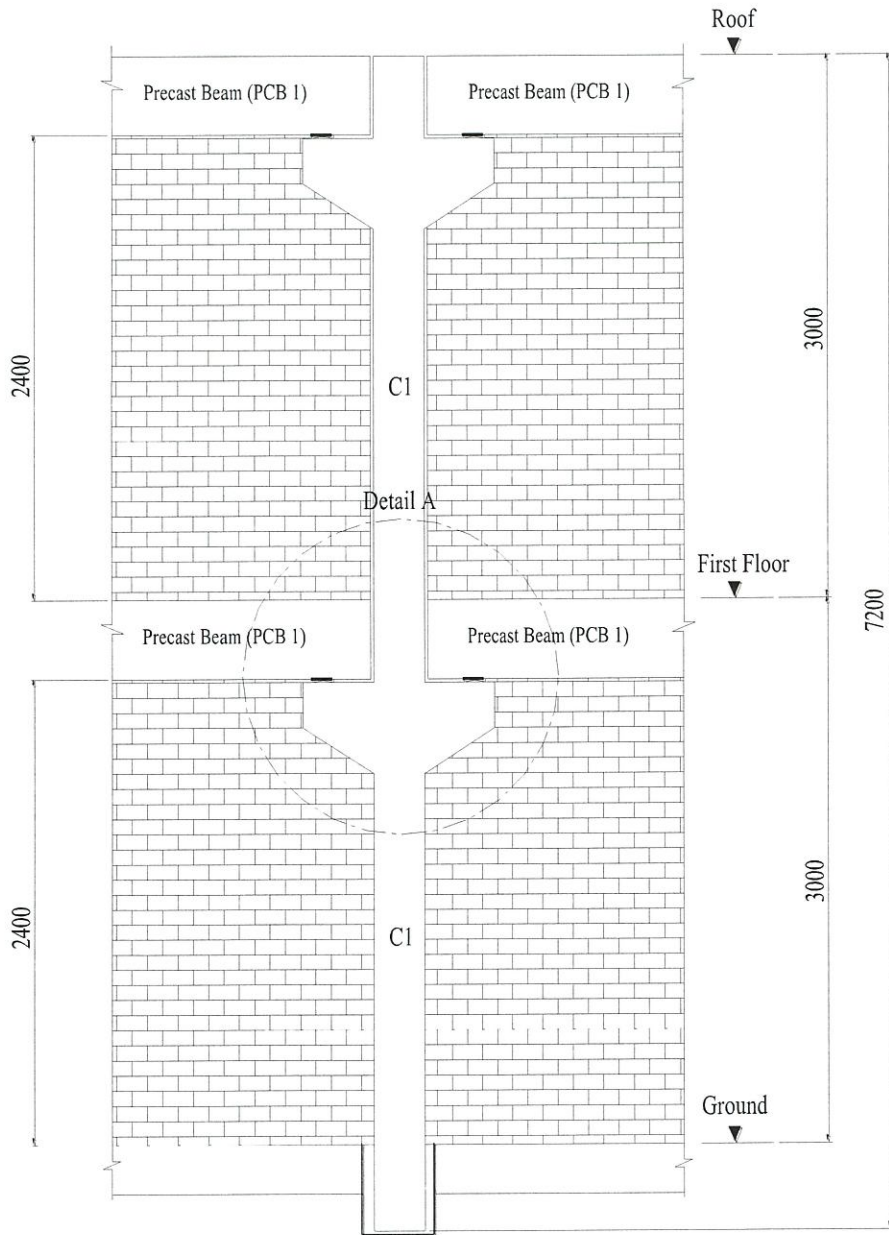
Floor Plan (Roof and First Floor)

FIGURE Q1(a)

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Elevation of Column C1

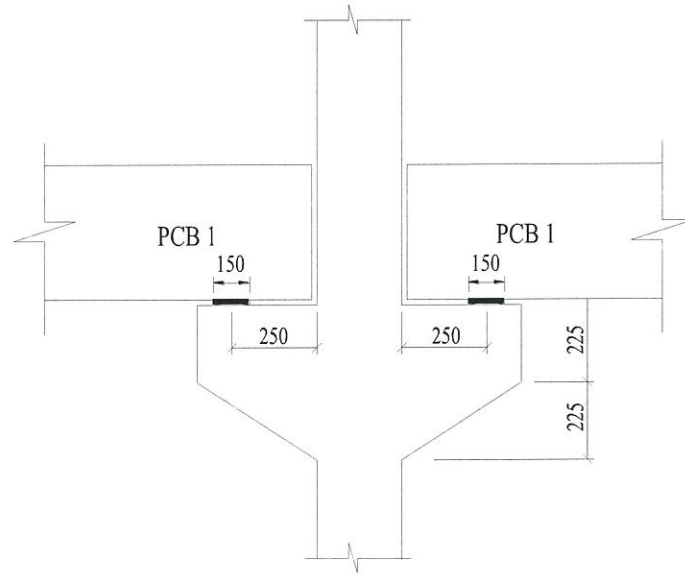
FIGURE Q1(b)

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Detail A

FIGURE Q1(c)

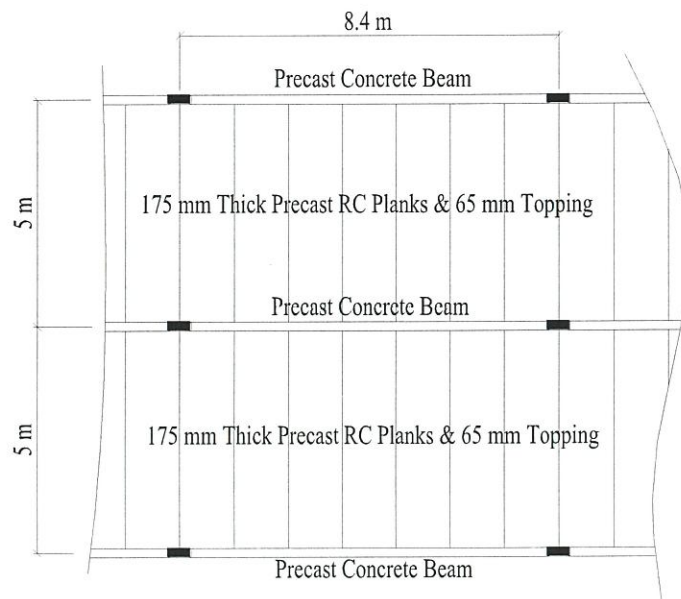


FIGURE Q2

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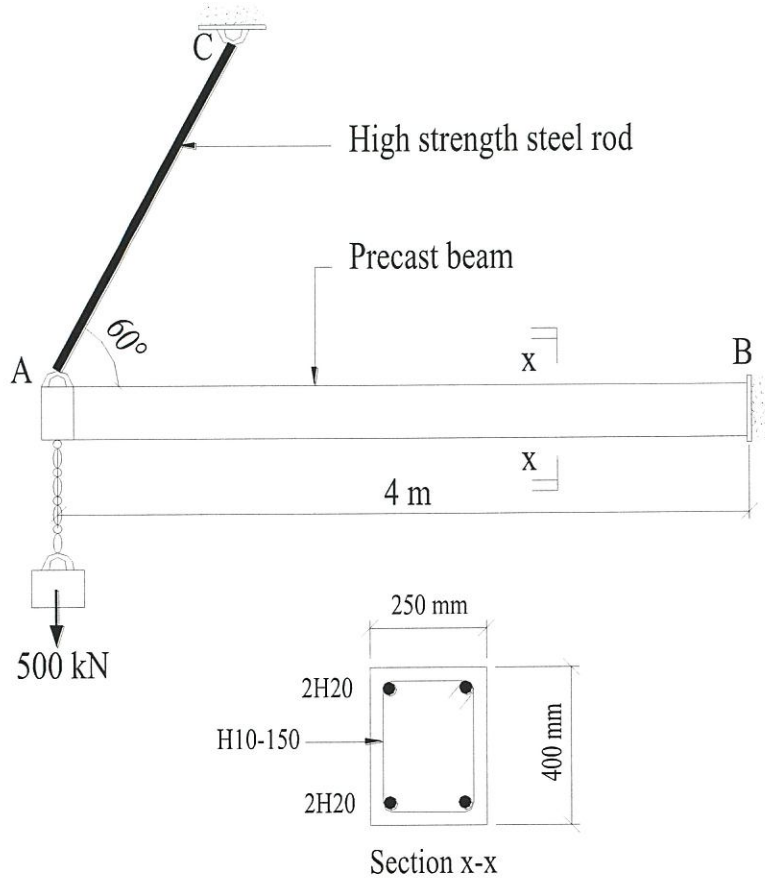


FIGURE Q3

TERMINAL A